

THE ARNOLD ARBORETUM DURING THE FISCAL YEAR
ENDED JUNE 30, 1946

1935 — 1946

THIS is my final report as Director of the Arnold Arboretum. My resignation was presented in June, but too late to be acted upon before the end of the fiscal year.* While I retain my academic title as Arnold Professor of Botany, Harvard University, for the next two years, and will continue to work at the Arboretum, I will have no further administrative responsibilities. As a matter of record I attain the age of 70 in October of the present year, and will become *emeritus* at the end of June, 1948.

Under the reorganization plans as outlined in the Bailey report which was officially approved March 1, 1946, the position of Administrator of Botanical Collections was officially terminated, and I was relieved of all responsibilities effective at the end of June, 1946. The projected reorganization of the very complex botanical situation at Harvard University involves a much closer affiliation of the nine separately endowed units in botany with the Department of Biology of the University, and a closer coördination of their work with that of the Department, both in teaching and in research. The new plan provides for a Biological Council under which will function two chairmen, one in charge of the Institute for Research in General Plant Morphology, the other in charge of the Institute for Research in Experimental and Applied Botany.

Thus in the case of the Arnold Arboretum, the largest and most complex of the nine separately endowed institutions concerned, all of its inside activities, such as the herbarium, library, and certain types of laboratory work, will fall under the purview of one chairman, while all matters appertaining to the maintenance of its grounds and plantings, and those phases of research that deal with the living plants, will fall under another chairman; and its general policies, research, publications, and teaching program will be developed and supervised by the chairmen and the Council. An executive officer will be designated to handle normal current affairs of the institution. This is indeed a very radical change.

Furthermore, the approved plan involves the construction of a major building in Cambridge designed to house all of the library and herbarium activities of the Gray Herbarium, the Farlow Herbarium, and the Arnold Arboretum, which means within the course of a few years the transfer of practically all of the inside staff of the Arboretum to Cambridge, and a corresponding reduction in the amount of work now prosecuted in Jamaica Plain. This move will clearly very greatly simplify what is a very complex situation, greatly reduce duplication and even triplication of effort and expense in certain fields, and will make the unique library-herbarium facili-

* On July 15, 1946, my resignation was accepted effective July 31, 1946.

ties of Harvard University much more accessible to all staff members and to graduate students than is now the case with three geographically separated units in the same general field. This matter has been discussed in previous reports. It will, however, very greatly reduce the Arnold Arboretum operations in Jamaica Plain, for there, in the future, will be prosecuted only those phases of its activities that appertain to living plants. These activities may, of course, be amplified in the course of time.

In my term of service as Director of the Arnold Arboretum since the latter part of 1935, an attempt has been made to maintain and to increase its prestige, not only as a local institution catering to the general public, but also as a national and international one in the research and publication fields. As funds became available there was no hesitation in amplifying its field of operations both at home and abroad. Thus its field work in China was greatly extended, and activities were initiated in India, Indo-China, Burma, Siam, Malay Peninsula, Philippines, Java, other parts of the Malayan region, Papuasia, Australia, New Caledonia, various parts of Mexico, Central America, South America, the West Indies, and even parts of Africa. In selecting areas outside of China, careful attention was given to those regions from which it was clearly evident that the institutional reference collections should be increased. These extensive operations were for the most part financed by grants made to competent and dependable residents of the regions involved, and the results have been outstandingly successful. Field work on the part of staff members of the institution has been financed from regular institutional funds, or through special grants secured from this or that foundation, in Canada, various parts of the United States, Mexico, Central America, and the West Indies. Thus in a decade the herbarium has been increased, in part by exchange of duplicates, in part through actual purchase of material, but largely through its own field efforts by more than 220,000 mounted sheets. Very extensive exchange credits have been established with botanical institutions in all parts of the world through the actual distribution of sets of duplicate specimens acquired through these various field operations. Within Harvard University, because of the vast accessions of material received through its sponsored field work, in excess of 130,000 specimens have been transferred to: the Gray Herbarium (123,000), Farlow Herbarium (2,470), and the Ames Orchid Herbarium, Botanical Museum (4,800), while in excess of 6,400 illustrations of plants with accompanying descriptions have been transferred to the three units mentioned. All of this was from currently received material outside of the field covered by the Arboretum, namely herbaceous plants, ferns and cellular cryptogams.

Efforts were made also to increase the already extraordinary library holdings of the institution, and by certain staff additions, more extensively to utilize the vast amount of published data therein available. Furthermore, the publication field was amplified, the technical Journal increased in size, and various and sometimes very extensive special publications were sponsored, even when it became necessary to seek financial aid outside of

the regular budgetary income of the institution. Two of the older serial titles were dropped in favor of shorter and more concise ones in *Arnoldia*, to replace the *Bulletin of Popular Information*, and *Sargentia*, to replace the *Contributions from the Arnold Arboretum*; the new names, incidentally, commemorate James Arnold (1781-1868), whose initial modest bequest made the establishment of the institution possible, and Charles Sprague Sargent (1841-1927), who actually developed it and initiated its policies on a broad base.

In maintaining the Arnold Arboretum, as to its grounds and plantings, Harvard University is most efficiently serving the public of the Boston Metropolitan area. This is proved by the enormous number of casual visitors that inspect its grounds and plantings each year. While we do not have even an approximation of the total number of annual visitors, close estimates made on certain days in the spring flowering season, from late April to early June, indicate that on occasion there may be in excess of 50,000 visitors in a single day. This is free service to the public and incidentally a very greatly appreciated service. This is, however, but a part of its local service, for as an institution it operates as a free source of information to the interested public on matters associated with plants, plant problems, and plant names. In addition to this local service a continuous effort has been made to make the institution not only more and more a national one, but also more and more international as well, in line with the general policies of Harvard University.

From a national standpoint the Arboretum not only attracts visitors from all over the country, but also from foreign lands as well. Its information service extends to all parts of the country to professional horticulturists and botanists, and to amateurs. For many decades it has served the extensive nursery interests of this and of foreign countries as well, by making available living plants, cuttings, and seeds from its more striking or interesting introductions. Throughout its history it has maintained a very high place among botanical institutions both at home and abroad, in financing its own exploring expeditions to various parts of the world with a view to introducing into cultivation new plants of potential economic or horticultural interest; and in this field it has been outstandingly successful. It has been one of our objectives during the past decade to maintain and to increase this service.

From an international standpoint the position of the Arboretum has always been clear. It has greatly increased the store of cultivated woody plants in Europe and in Great Britain, as it has within the United States. It has cooperated with foreign institutions very fully in the interchange of reference material, living plants, seeds, publications, and general information. In the past decade many of these activities have been increased, some rather radically. At the same time it has played its part in the training of graduate students, both citizens of the United States and of foreign countries, who have elected to major in this or that field covered by the Arboretum.

The material resources of the institution have been very considerably increased in the past decade. This applies not only to its library holdings and its collections of reference material, photographs, and records, but also to the financial field as well. Its chief source of support is the income from its own restricted endowment, and in the past decade this endowment has been increased by approximately \$321,500.00, in spite of the 10% write-down of its capital in 1936 to offset the 10% write-up in 1930. As a matter of record the actual additions to capital received in the year just closed approximate \$365,000.00, with considerable additions to be received in the coming year under the provisions of certain wills now in probate. In addition to this increase in its endowment funds, a total of about \$112,000.00 has been received within the decade in the form of gifts for immediate expenditure, mostly unrestricted, but in some cases restricted, to use for such purposes as fellowships, scholarships, special-travel, exploration, or publication. This amount does not include certain special grants, the total a distinctly considerable sum, that were received from such sources as the Milton-Clark fund and various other endowments for the support of this or that research project carried on by various staff members; nor does it include special grants made to support field work, such as the two seasons operations on the Alaska Military Highway.

When one considers that the decade 1935-46 covered the last half of a long continued financial depression which actually ceased only after the most destructive war of modern times was initiated, the financial record must be considered as at least satisfactory. It was from the gifts for immediate expenditure that much of the expansion activities were financed in the past decade, for the normal income in general sufficed only to take care of obligated charges.

As this report coincides with the end of an era it has been deemed pertinent to include here the following summary of the present endowment of the Arboretum, showing how it has been built up by gifts and by bequests from the modest initial sum of \$99,223.21 in 1872 to its present impressive total of \$3,215,983.69.

ARNOLD ARBORETUM ENDOWMENT FUNDS

Arboretum Construction Gifts (balance)	\$91,223.21
Arnold Arboretum (1899)	125,650.00
Arnold Arboretum Endowment (1917)	431,661.64
Arnold, James (1872)	176,945.34 ^a
Billings, Robert Charles (1904)	13,500.00
Bradley, William L. (1897)	21,040.00
Burr, Lucy Williams (1925)	47,051.78
Bussey Fund for the Arboretum (1903)	2,308.06

^a The initial fund in 1872 was \$99,335.48, but under the terms of indenture 5% of the income is added to capital each year.

Case, James Brown (1942)	50,000.00 ^b
Case, Laura Lucretia (1925)	24,999.96
Case, Marian Roby (1945-46)	365,137.09 ^b
Collamore, Helen (1916)	2,525.00
Cowell, Helen E. (1932)	50,000.00
Cowell, Mr. & Mrs. Henry (1932)	50,000.00
Crocker, Annie Bliss (1930)	5,000.00
Edwards, Grace M. (1939)	25,355.56
Estabrook, Arthur F. (1923)	5,000.00
Estabrook, Ida F. (1925)	5,285.00
Evans, Maria Antoinette (1919)	22,240.76
Hutchinson, C. L. (1932)	29,518.60
Jewett, James R. (1940)	5,000.00
Judd, William H. (1946)	2,832.50
Loring, William Caleb (1930)	25,000.00
Mass. Soc. Promoting Agriculture (1911)	13,375.00
Phillips, Anna T. (1925)	5,000.00
Pratt, Harriet B.	5,000.00
Richards, Anna M. (1931)	423,057.22
Sargent, Charles Sprague (1928)	21,613.47 ^c
Sargent, Charles Sprague (1928)	20,083.17
Sargent, Charles Sprague Memorial (1926)	1,048,489.26
Sargent, Mary Robeson (1919)	8,309.37
Shaw, Isabella P. (1925)	8,644.55
Skinner, Francis (1906)	20,000.00
Skinner, Francis, Jr. (1915)	10,000.00
Thayer, Bayard and Ruth S. (1911)	25,042.75
Weld, Stephen M. (1917)	25,000.00
Whitney, Edward (1912)	2,881.97
Williams, Adelia C. (1927)	1,000.00
TOTAL	\$3,215,983.69

^b Does not include the value of extensive real estate holdings in Weston.

^c The original fund was \$10,000.00, income to be added to capital for 100 years before any part of it can be used.

One may legitimately express the hope that the institution will continue to expand within its field, and that it may increase its contributions to the enjoyment of the public, to education, to research, to the services of amateur and professional horticulturists, locally and all over the country, to professional botanists, to its sister institutions everywhere, and to plant science in general within the fields that it covers, and thus justify its continuance and support. Too often in the case of biological institutions, more particularly those within the botanical garden area, when expansion ceases, stagnation or decline sets in.

Were I asked to indicate what I consider to be the greatest immediate need of the institution at this, the close of the seventy-fourth year of its existence, my response would be a restricted publication fund; i.e., one the income of which would be restricted for use in financing the cost of publishing popular and technical information within the arboretum field. Too often when necessary retrenchments in institutional budgets are made the publication funds are among the very first items to be reduced, or even eliminated, such funds apparently being looked upon more in the nature of a luxury than as a necessity. It is rather curious to note that for the support of research, provided one has a legitimate project, one may literally approach dozens of sources of funds and actually receive grants — frequently very generous ones — to support research; but not a cent, usually, for publication expenses. Unless the results of research be published they do not, in general, become widely available. The initial capital of such a fund need not be large, for it would be possible judiciously to increase it over a term of years by adding to capital annually the receipts from sales of subsidized publications. Here it is pertinent to remark that for a high percentage of research publications subsidization is essential to publication, for the demand for much of the output comes not from individuals so much as it does from institutional libraries. Thus the sales field is limited. In plant science the actual value of a research paper cannot be gauged by the number of copies sold. I merely observe here that the Arnold Arboretum needs no further publicity; but the knowledge of its activities in the world at large — and it is one of the most widely and most favorably known units of Harvard University — comes very largely from its widely distributed official technical and popular publications.

In 1947 the Arnold Arboretum will attain the age of 75 years. It has been my pleasure, privilege, and honor to direct its activities over the past decade, ten years charged with many difficulties due to a variety of causes, including the most destructive hurricane ever experienced locally since 1620, two recent winters with unusually heavy ice damage, an unusually large number of destructive grass fires in abnormally dry seasons, financial difficulties of one type or another, the extraordinary restrictions of the war years, with the concomitant labor shortages, radically increased cost of labor, and difficulties in relation to supplies and equipment. While I shall have no administrative responsibilities on the occasion of the institution attaining its 75th anniversary, it can only be assumed that continued success will be in store for what is, in its field, the pioneer institution, for it is actually the oldest Arboretum in the world. It is also the outstanding institution of its kind and the progenitor of between fifty and sixty arboreta in the United States alone. Some of these are small and largely built on hope and enthusiasm, but others are large and well-endowed. Thus it is that from its modest beginnings in 1872 with an initial endowment of slightly less than \$100,000.00 the Arnold Arboretum has developed into an outstanding cultural, educational, and research institution as its material resources have increased; for its modest initial endowment has been

increased by gifts and by bequests by more than thirty fold to the impressive total of \$3,215,983.69, to be further increased within the coming year by additional impressive sums.

1945 — 1946

Financial. — Normally the institution has been operated within the limits of its annual income, but in certain years, especially during the war when the labor staff was at low ebb and we could not purchase desired equipment, the departmental balance was fortunately increased. In 1935 this balance was \$16,058.19, and at the end of 1945 it had been increased to \$40,507.06. The year just closed was exceptional in that the actual overdraft or deficit was \$12,108.29, which was charged to this reasonably ample departmental balance. Authorization was granted in advance for this overdraft. The causes were several, chiefly two blanket increases in labor rates, and a ten percent increase in all salaries for individuals receiving \$3,000.00 or less per year, and for which no budgetary provisions had been made in advance. The badly depleted labor staff was increased, this being imperative because of the deplorable condition of many of the plantings due to lack of care in the war years. There was, of course, an increased cost for supplies and equipment, and further an unavoidable delay in the settlement of the Marian Roby Case estate. Thus it was that the maintenance costs of the Weston real estate that came to the Arboretum as a part of her bequest, assumed April 1, 1945, had to be continued as a charge against the regular Arboretum income for the year 1945-46. With the payment of a large part of the Case bequest in June, 1946, this matter is now adjusting itself.

The endowment funds of the institution were increased during the past year by a total of \$365,137.09, very largely from the Marian Roby Case bequest. Toward the end of the year the modest William H. Judd Memorial Fund was established through certain voluntary gifts, now amounting to \$2,833.50. Additions to capital under the terms of gift of two items amounted to \$1,253.72. Still to be received is the final balance of the Marian Roby Case bequest and all of the Katherine Balch bequest mentioned last year.

In addition to income from endowment and from miscellaneous sources on which the actual budget is based, the extra-budgetary Cultural Purposes Fund was increased by \$5,704.00 from 172 individuals, and the special Publication Fund was further increased by gifts from 33 individuals in the amount of \$5,275.00, this fund now being apparently sufficient for the immediate publication needs of the institution. One grant of \$600.00 was received from the Penrose Fund, American Philosophical Society, for use in support of a bibliographic research project. Two grants have been made to support Dr. A. C. Smith's projected botanical exploration of Fiji, from the Guggenheim Foundation and from the Penrose Fund of the American Philosophical Society. The total of all gifts for immediate expenditures was \$15,679.00.

Staff. — There have been few staff changes. The institution suffered a very severe loss, on May 23, in the sudden and unexpected death of William H. Judd, for 33 years a member of its staff. Mr. Judd was in charge of plant propagation, and of the accessions and distribution records. He was a veritable one-man bureau of information on plants, plant problems and plant names, being actually one of those irreplaceable persons. See *Arnoldia* 6: 25–28, *portr.* 1946. Dr. H. M. Raup was promoted from an Assistant to an Associate Professorship, and under the reorganization plan he has been designated as Director of the Harvard Forest. Dr. C. E. Kobuski, after three years in the military service, reported for duty in August, 1945. In May, through arrangements made by the new chairmen, Mrs. Beatrix Farrand was added to the staff, on a retainer basis, as Consulting Landscape Gardener. The other changes have chiefly been in the labor field, where significant and very badly needed addition to the labor staff has been made.

Instruction. — The graduate student situation remained about as it was during the war years. With the close of the war the number of inquiries radically increased. The present prospects are for a distinctly increased number of graduate students in 1946–47 who wish to specialize in the general field covered by the Arboretum. The Bailey report, briefly mentioned last year, was finished and submitted during the year. It was officially approved by action of the Corporation March 1, 1946, and as the new plan goes into effect it will apparently have far reaching effects on the future program of the Arnold Arboretum, and particularly in reference to the relationship of its staff members to Harvard University through the Division of Biology. In general it should greatly strengthen the advanced instruction in botany through a closer association of staff members of the separately endowed units, of which the Arnold Arboretum is one of nine, with the botanical staff of the Division of Biology of Harvard University.

Buildings, grounds, and horticulture. — The normal amount of attention has been given to all buildings to maintain them in good condition, and certain work has been done on the newly acquired residences and other buildings on the Case Estate in Weston. A survey of maintenance costs was made during the year to see if certain savings might not be made were all building repair services turned over to the Maintenance Department of Harvard University. However, the estimates submitted showed an increased cost of several thousand dollars, and so no change was made.

We are indebted to a group of lady members of the Board of Overseers Committee to Visit the Arnold Arboretum, all personal friends of the first director of the institution, for their initiative in having prepared a special memorial to Dr. Sargent. This took the form of a beautifully designed and executed bronze plaque, 30 by 21½ inches, which was installed May 12,

1946, on the right hand pillar of the Jamaica Plain gate. The inscription reads:

CHARLES SPRAGUE SARGENT

1841-1927

ARNOLD PROFESSOR OF BOTANY

IN HARVARD UNIVERSITY

FIRST DIRECTOR OF

THE ARNOLD ARBORETUM

1872-1927

THE ARNOLD ARBORETUM, HIS CREATION,

IS A LIVING AND ENDURING MEMORIAL

We are under very special obligations to Mr. William P. Long, Chairman of the Boston Park Department, for his continued interest in the Arboretum and its problems, as evidenced by the entire renovation of the road surfaces in May by the Park Department. Very extensive repairs were made as needed and the entire road, except that in the Peters Hill section, was re-tarred.

The attractiveness of the grounds decreased during the war years due to circumstances beyond our control, chiefly labor shortages and our inability to acquire needed equipment. Some of the plantings actually approached a deplorable condition. There has been some criticism of the conditions of the plantings, but this has come largely from individuals who maintain no estates and who hence were not in a position to judge fairly. Estate owners, subject to perhaps even greater restrictions than was the Arboretum during the war years, very generally understood the situation.

Following the close of the war this matter was critically considered. Two staff members returned to service following their honorable discharge from the Army, Mr. Heman Howard as Assistant Horticulturist and Mr. Alfred Fordham as Assistant Propagator. We were fortunate in securing the services of a well trained and skilled tree specialist who has the pruning program well under control. Because of the really vast amount of work that needs to be done, it is estimated that it will take him a year or two to go over all of the plantings. In the meantime, however, special attention is being given to those trees that are most conspicuous or in most need of attention, the results of his work being already evident. In any event the trees and shrubs are now receiving the care that could not be extended to them during the war years. Three ex-service men have been added to the labor force, bringing its total up to fourteen. The services of four high-school boys were secured for the summer months. With this additional labor we can, even within the present open season, go far in repairing the ravages due to neglect of plantings, damage by snow and ice, and that by storm and fire. As a simple example, over fifty truck loads of dead or

superfluous stems and branches were removed from the lilac collection alone, and several other collections have been dealt with proportionally.

We have acquired certain new equipment, this being necessary to keep labor costs within bounds. Included are two sickle-knife mowers for use in those areas where the tractor cannot be utilized to advantage. The most useful item is a Worthington "Grass Blitzer" mower, the five reel type. Its use in the extensive linden, maple, elm, and beech areas eliminates all work of raking and hauling hay. The areas are maintained in much more presentable condition, and the grass clippings left on the ground materially benefit the soil. The Ford-Ferguson tractor has increasingly proved its worth, being in almost continuous use. The radically increased cost of labor forces us not only to become more and more mechanized, but also to keep the machines working continually. We are constantly looking for specialized machines, by the use of which hand labor can be eliminated, for it is only by the utilization of such labor-saving devices that we can hope to cover the amount of work that must or should be done and at the same time keep within the budget allotment. An outstanding example of reduced labor costs is that shown by the maintenance of the shrub collection. This large tract was formerly cultivated entirely by hand. With a judicious rearrangement of the beds, elimination of alternate grass walks, and other improvements permitting the use of mechanical equipment and weed killers, most of the hand work has been eliminated and the actual cost of maintenance reduced to about one-fifth of what it was before the new system was installed. In conjunction with labor costs Mr. Williams has installed a simple daily record, so that we can now determine the exact number of man-days and boy-days involved for thirty-five different classifications.

On the Case Estates in Weston, a considerable amount of work was required in eliminating certain plantings, thinning of others, and general work in cleaning up of certain buildings, with essential repairs as necessary. The nursery space was enlarged and some large seed beds established. Several thousand cuttings were rooted in connection with certain projected horticultural investigations. The large fields were again cover cropped, in preparation for planting in the spring of 1947. At times when the necessary work at Weston is under control the men report at the Arboretum for work on its grounds.

The town of Weston, seeking a site for a new elementary school, studied three possible tracts, two of them on land already owned by the Arboretum and another on adjacent land. Since it seemed possible that the more desirable tract, from our standpoint, might be taken under the right of eminent domain, the University offered about forty-one acres, including the buildings thereon, to the town for the very modest sum of \$10,000.00. This was from the Louisa W. Case gift of 1942, and the arrangement was made with her full knowledge and consent. As this was practically a gift to the town of Weston, the local authorities were greatly pleased, and this augurs well for our future relationships in Weston with the local residents and town officials.

Through an agreement made with the Department of Landscape Architecture, Graduate School of Design, Harvard University, that unit has been granted the use of several acres on the Marion Robey Case estate for the possible development of demonstration plantings. The Arnold Arboretum is free of any financial obligation in reference to this project. The use of the land, which is not adapted to anything we may wish to do in Weston on behalf of the Arboretum, was granted to the Landscape Architecture Department as a courtesy.

It became necessary to remove the remaining material in the nursery adjacent to the State Serum Laboratory building in the spring. Some of the plants not needed for Arboretum purposes were presented to the University and to Radcliffe College. The valuable plants needed by the Arboretum were moved to Weston and planted in a special nursery there. The large nursery on South Street will be continued for another year, after which some of the plants will be placed in the collections and others will be transferred to Weston.

During the year 59 living plants, 72 lots of cuttings and scions, and 25 packages of seeds were received from various sources in the United States and a few packages of seeds from foreign countries. To various institutions and individuals in the United States and Canada 261 living plants were distributed as well as 163 lots of cuttings and scions and 60 packages of seeds, and a few packages of seeds were sent to institutions abroad.

With the close of the war, interest in the Arboretum has become evident in the greatly increased number of visitors. Very many of these have the interest of the institution at heart and their very presence assists materially in protecting the place against vandalism on the part of irresponsible boys. On May 15 the institution was honored by acting as host to more than five hundred delegates to the National Convention of the Garden Club of America, this large group being escorted through the grounds by staff members of the institution. Arrangements have been completed to stage certain important demonstrations in the Arboretum for the meeting of the National Arborists Association in the late summer.

Perhaps as one result of reductions of controls during the war years, it is becoming increasingly evident that vandalism in the Arboretum is approaching an all-time high. One evidence of this is the extraordinary number of grass fires during the drier parts of the spring and fall seasons. In one recent season we experienced more than seventy fires, more than half of which were so serious that the fire department services were required. During the last year when the spring and fall seasons were fortunately not so dry, there were about forty fires. These are obviously set by boys. Since the Arboretum is open to the public from sunrise to sunset every day in the year, these young vandals cannot be excluded; neither can the Arboretum maintain guards at all times, before and after working hours, Sundays and holidays.

However, when the weather is such that the fire menace is acute, practically the entire maintenance force is distributed to strategic points and

assigned the task of watching all groups of boys. When holidays and after office hours are involved this increases our labor costs, as we must pay the men one-half more per hour than the regular scale. Naturally time devoted to watching for fires distinctly reduces the labor efficiency, for while so assigned the men can do little or no regular work. Police protection has been meager during the war years for the simple reason that the Police Department has been undermanned and overworked. Courteous treatment is always extended to the Arboretum by members of both the Police and the Fire Departments; and yet these constantly recurring fires constitute a distinct burden of expense on the Boston Fire Department. We have attempted to reduce the fire hazards as far as this could be done with our limited force. In the Peters Hill area strips were plowed and harrowed to form fire lanes, thus materially reducing the number of fires there and limiting their extent.

Two years ago the greater part of our magnificent collection of dwarf evergreens was destroyed by fire, and what remains is in a precarious position. Last year saw the destruction of a fine collection of Chinese firs near South Street; this past season our juniper collection was seriously damaged — and so it goes. What the institution needs and needs very badly is a uniformed guard supplied with proper transportation who shall be on duty at those times when the fire menace is great. Possibly satisfactory arrangements could be made with the Police Department, whereby the Department would be reimbursed on a per diem basis to cover services rendered. The situation is indeed a most serious one.

My personal opinion is that we should plan to protect what we have before we further expand staff activities by the creation of new positions in this or that field; and certainly a guard can be provided for from the additional income that will become available when certain bequests are paid in. We must keep in mind that the development of open spaces with closely cut grass attracts the baseball players among the youth in the spring and summer, the football players in the fall, and the amateur golf players at all seasons; and when a strip is opened down a slope this becomes an attraction for coasting and skiing in the winter. True it is that such activities are prohibited within its grounds, but the prohibition is not now and cannot be enforced without a properly authorized guard.

The appointment of Mrs. Beatrix Farrand as Consulting Landscape Gardener consummated in May should materially assist in the solution of certain outside problems. Her objective will be to initiate plans that will bring the living collections of the Arboretum to the highest possible degree of usefulness and attractiveness to the general public. Mrs. Farrand, once a student under Charles Sprague Sargent at the Arboretum, has been Consulting Landscape Gardener to Princeton University, Yale University, Dumbarton Oaks, and other important institutions in the country.

Plant Breeding. — Many of the ornamental apple hybrids bloomed last

spring and the better types have been selected for propagation. The new varieties are budded on *Malus toringoides* root stocks and are grown to flowering age before final selections are made. Consequently about ten years must elapse before final selections are made and the new varieties are released to growers.

Several promising new varieties of cherries, forsythias, and lilacs flowered for the first time. One of the most spectacular new hybrids is a dwarf azalea which last winter behaved as an evergreen. The evergreen segregates of *Berberis mentorensis* have not proved to be outstanding, but a few plants have been retained for further tests. Some variation was obtained in the F₂ generation of X-rayed *Berberis Thunbergi*, but the segregates are not of much value. Hybrids of red × silver maple have been set in permanent location and are making very rapid growth.

Root stock experiments have been continued in an attempt to obtain dwarfing stocks for ornamental trees and shrubs and to determine graft relationships. As is well known, certain combinations do well the first year but graft union is incomplete, and the scion dies the second year. In the Pomoideae, however, there is considerable compatibility between certain genera. The tree lilac has been used as a root stock for the common and Persian lilac with promising results. A Chinese lilac seedling budded on *Syringa amurensis japonica* made more growth in one season than it had made in six years on its own roots. Budding or grafting of hybrid seedlings may avoid the high mortality of seedlings of certain species crosses.

A cytological study has been made of bigeneric hybrids of which *Sorbus* was one of the parents, including *Sorbaronia*, *Amelasorbus*, and *Sorbopyrus*. All of these hybrids show considerable cytological irregularity, although all are partially fertile. Work has been continued on the effect of temperature variations on X-ray induced chromosomal aberrations.

Wood Anatomy. — Professor Bailey and his co-workers, in continuation of their investigations of the comparative morphology of the dicotyledonous families, concentrated on an intensive investigation of the foliar morphology of *Illicium*. This work was carried on in coöperation with Dr. A. C. Smith as to the taxonomic phases of the subject. The accumulated morphological evidence indicates that this genus belongs in an independent family closely related to the Schisandraceae. It indicates no close relationships to either the Magnoliaceae (sensu stricto) or the Winteraceae. While *Illicium* as a genus is sharply characterized by a number of salient, relatively stable, diagnostic, and phylogenetically significant structures, the problem of differentiative taxonomic entities within the genus is a difficult one, the morphological boundaries between species commonly being vague and indefinite. Miss Lillian Nagle is completing a morphological study of the Monimiaceae for the doctorate, and Mr. W. Spackman, Jr., is initiating an extensive survey of the salient trends of specialization in the wood parenchyma of the dicotyledons.

The Herbarium.— The total number of specimens mounted during the year was 13,248, of which number 6,178 were herbaceous specimens subsequently transferred to the Gray Herbarium as noted below. However, we removed from among material mounted and incorporated in previous years a total of 5,755 specimens (5,740 of which were herbaceous plants and 15 of which were duplicates); as a result the actual growth of the herbarium was only 1,315 specimens. The total number of mounted specimens now in the herbarium is 631,452. In a way it is fortunate that the present rate of growth is slow, since all expansion space has been filled and further distribution of material into the collections cannot be made under existing conditions. The mounting staff spent a considerable proportion of their time mounting the photographs from the Linnaean Herbarium, mentioned elsewhere in this report, and in addition some time was devoted to repair work. A limited number of clippings and mounted illustrations was inserted into the herbarium.

Although accessions during the war years have necessarily been below normal, a greater influx of material is to be expected in the near future. Certain institutions in China and other parts of the Old World have been accumulating substantial amounts of material on behalf of the Arboretum, and shipment of this may be expected as soon as transportation conditions permit. These forthcoming acquisitions will increase the strain upon our storage facilities; at present the available space for storage of unmounted duplicates, like the herbarium, is crowded to capacity.

During the fiscal year the Arboretum received approximately 54,999 specimens, acquired in the following manner: gifts, 1,673; for identification, 2,705; subsidy, purchase, or on salary basis, 18,405; and exchange, 32,216. The largest single acquisitions were 25,533 Argentine specimens received from the Instituto Miguel Lillo, Tucumán, in exchange, and about 5,000 specimens from the same institution received on a subsidy basis. Other important collections were about 3,000 specimens collected on San José Island, Panama, by Dr. Johnston; 8,769 specimens collected in Minas Geraes, Brazil, by Dr. Louis O. Williams on behalf of the Arboretum (the material subsequently transferred to the Gray Herbarium for study and distribution); and 612 specimens received in exchange from the Naturhistoriska Riksmuseet, Stockholm. A geographical breakdown of incoming material shows the following: South and Central America, 46,463; United States and Mexico, 3,157; West Indies, 1,112; Canada, 984; Pacific Islands, 1,285; Australia, 255; Europe, Africa, and Asia, 1,061; miscellaneous (mostly cultivated), 682.

The Arboretum sent to other institutions a total of 29,558 specimens; as usual in recent years the bulk of this material was transferred to other departments of Harvard University as inter-institutional transfers, as follows: to the Gray Herbarium 23,467 specimens (17 for identification, 12,107 mounted specimens transferred, 10,588 unmounted specimens transferred, and 755 mounted illustrations transferred); to the Ames Orchid Herbarium at the Botanical Museum 439 specimens (81 for identification,

90 specimens and 268 mounted illustrations transferred); and to the Farlow Herbarium 327. To other American institutions we sent 4,453 specimens in exchange, 281 specimens for identification, and 18 specimens as gifts; to non-American institutions went 186 specimens in exchange, 380 specimens for identification, and 7 specimens as gifts. Microfilms, photostats, and publications to the value of 861 specimens were sent out on an exchange basis. The total number of specimens or their equivalent distributed by the Arboretum, therefore, was 30,419.

To 18 institutions (14 American and four foreign) the Arboretum made 33 loans totalling 1,301 specimens; members of our own staff received 49 loans from 17 institutions (11 American and six foreign), totalling 2,303 specimens.

To the catalogue of references to new species and other important literature pertaining to woody plants 2,511 cards were added, bringing the total number of cards in this catalogue to 141,161. Only 28 negatives were added to the collection representing types and other critical species; this collection of negatives now totals 4,239.

In addition to carrying on the usual amount of routine work, staff-members continued their special researches. Professor Rehder brought to completion the major project which has occupied him in recent years, namely the preparation of a Bibliography of Cultivated Trees and Shrubs. This extensive work is now in press, and its appearance will be welcomed by the numerous individuals who make frequent use of Prof. Rehder's Manual of Cultivated Trees and Shrubs, of which the Bibliography will be in some respects a supplement. Dr. Smith, continuing his collaborative studies of the Ranales with Prof. Bailey and Dr. Nast, worked on the genera *Illicium*, *Schisandra*, and *Kadsura*; a revision of these important genera is now approaching completion. In order to make possible a projected exploration of the Fiji Islands, Dr. Smith applied for and was awarded a John Simon Guggenheim Memorial Fellowship, for use in 1947. He also received a grant from the Penrose Fund of the American Philosophical Society, for application toward the same project. Dr. Smith plans to leave in February, 1947, to spend about nine months in Fiji in continuation of his field work undertaken there in 1933-34, with the intention of obtaining sufficient material to make feasible the preparation of a modern descriptive Flora of Fiji.

Dr. I. M. Johnston continued his collaboration with the Chemical Warfare Service in relation to the San José Project. From December, 1945, to February, 1946, on army orders, he made his third trip to San José Island, Gulf of Panama. As a result of his association with this project he had exceptional opportunities for the study of tropical vegetation and for assembling reference material. In recognition of his work during the tests at San José he was awarded a citation in August, 1945, by the Chief of the Chemical Warfare Service. Much of the detailed data that he assembled regarding San José Island and its vegetation can now be published. His detailed report, the preparation of which is now well advanced, will appear in *Sargentia*.

Dr. H. M. Raup devoted most of his time to the completion of two papers, one published, one in press, the former being his phytogeographic consideration of the Athabaska—Great Slave Lake region, published in our Journal in 1946, and the latter his Botany of Southwestern Mackenzie, which is now in press as a number of *Sargentia*.

Dr. Kobuski, after an absence of three years in military service, returned to his position at the Arboretum in August; resuming his work on the family Theaceae, he is undertaking a revision of the genus *Adinandra*. Mr. Palmer completed his revision of the genus *Crataegus* in the north-eastern United States and adjacent Canada, and he is continuing his investigations of the taxonomy of hybrid oaks. Dr. Allen, after completing her manuscript revising the Lauraceae of Panama for inclusion in Woodson & Schery's Flora of that country, has begun assembling material and data for a study of the South American representatives of the Lauraceae. Dr. Perry continued her studies of Papuan plants, with special reference to the large collections of the Richard Archbold Expeditions; she also prepared for publication translations of several scientific articles originally published in Dutch (for reference to these, see the bibliography appended to this report). Dr. Croizat continued his studies of the Euphorbiaceae, particularly of tropical America, while devoting much time to identifications of cultivated material.

My own activities, in the limited time that was available because of the pressure of administrative work, have been devoted largely to bibliographic matters and to identifying and reporting on various collections from the Old World tropics. Completed and published was the consideration of the technical names of plants proposed by William Bartram (1791), and completed and presented for publication a somewhat similar treatment of the Amos Eaton names (1817–1840). Progress has been made on a similar treatment of Muhlenberg's names (1813–1819), and the long continued Rafinesque project, the *Index Rafinesquianus* mentioned in previous reports, approaches completion and will be finished during the coming year. My Botanical Bibliography of the Islands of the Pacific, mentioned elsewhere in this report, was completed during the year.

Bibliography. — Dr. Frans Verdoorn edited volume three of the *Annales Cryptogamici et Phytopathologici*, and volumes seventeen and eighteen of A NEW SERIES OF PLANT SCIENCE BOOKS. *Chronica Botanica* was published in installments, being chiefly devoted to historical subjects. He also continued to act as advisor to the Board for the Netherlands Indies, Surinam and Curaçao in New York City, and to supervise the Central Depository Library for the Netherlands Indies, which he established in 1942. With Dr. Pieter Honig he edited *Science and Scientists in the Netherlands Indies*, which includes a detailed directory of scientists resident in the Netherlands Indies at the time of the Japanese invasion. For the Board he is now preparing a plan for an international visitors' research station to be established in the East Indies.

Much attention has been given to the basic *Index Botanicorum* project, about seven thousand sheets having been added to the file during the year. The services of numerous new collaborators have been secured, notably in Finland, France, the Netherlands, Sweden, and Switzerland. Much of the work has been done by Mr. Walter Baron, formerly of the Berlin Institute for the History of Medicine, with the part time assistance of several other persons. In connection with the development of this project the following files are being developed: — a collection of portraits of plant scientists; one of illustrations of botanical gardens and botanical museums; and one of autographs of plant scientists; a card catalogue index to the literature of the history of the plant sciences; and a similar index to the literature and other data on the history of botanical institutions.

For the first time since work on the *Index Botanicorum* project was initiated in 1942 it was possible for Dr. Verdoorn to assign to it personal funds. His present rate of expenditure is about twice the amount of the modest subsidy provided by the Arnold Arboretum.

Other important bibliographical projects include Prof. Alfred Rehder's *Bibliography of Cultivated Trees and Shrubs*, the printing contract having been consummated in May. It will probably take the better part of a year to see this major work through the press. The long continued work on the *Index Rafinesquianus* is practically finished, remaining to be completed being only the introduction, and this is well advanced. The Bartram project mentioned in last report was finished and published, while the Eaton manuscript was completed and is now being printed.

Because of expressed desires of officials of the Smithsonian Institution, work was reinitiated on a thorough revision of my *Polynesian Botanical Bibliography 1773-1935*, which was published in 1937, bringing it up to date and increasing the author-entries from about 2,600 to approximately 3,900. This covers the entire Pacific basin from Juan Fernandez and Hawaii to the Marianas, Caroline, and Palau Islands, and southward to New Caledonia. The revision was completed during the year and this extensive contribution is now in press as one of the official publications of the Smithsonian Institution under the title: — *A Botanical Bibliography of the Islands of the Pacific*.

Because of its remarkable library facilities the Arnold Arboretum has been strong in the bibliographic field, as witnessed by the *Bradley Bibliography (1911-1918)*, the *Bibliography of the Botany of Eastern Asia (1938)*, and its comprehensive library catalogue (1914-1923). It is fitting that extensive work in this field be accomplished here where it is possible to gain access to most of the published literature, even including numerous exceedingly rare volumes. It may be argued that such intensive work does not benefit the individual or the institution to any great degree, but this is actually a false argument. Good bibliographic work can be done in only a relatively few centers in the world, and this happens to be one of them. It should not be forgotten that the published output in the bibliographic field is very widely used by productive botanists and by

librarians all over the world, and that service rendered in this special field is very greatly appreciated elsewhere. In this sense the Arnold Arboretum is a world institution, not merely a local or national one.

Lithoprint reproductions of rare works.— Because of the very successful outcome of the lithoprint facsimile reproduction of the very rare "Sylva Telluriana" and "Autikon Botanikon" of Rafinesque in 1943, it was decided to extend this service more particularly for the benefit of the younger botanical research institutions in the United States and elsewhere. It is now practically impossible to acquire copies of certain basic works, and even when they are rarely offered the asking price is exorbitant. The newly reproduced works, all issued in 1946, are Rafinesque's "Flora Telluriana" (1836-1838), about 450 pages, "New Flora and Botany of North America" (1836-1838), about 404 pages, "Atlantic Journal" (1832-1833), 212 pages, Blume's "Catalogus," 112 pages, Gronovius' "Flora Virginica" (1739), 206 pages and its edition two (1762), 176 pages, and Walter's "Flora Caroliniana" (1788), 252 pages. The modest unit prices for these modern reproductions vary from \$2.00 to \$5.00, depending on the number of pages involved.

It may legitimately be pointed out that here is a field in which older institutions with very ample library facilities can be of distinct service to more recently established ones. Of one of the above titles the only known copy in all of the botanical libraries of North America is the one on the shelves of the Arnold Arboretum library; because of the nature of the work it ought to be available in the libraries of all institutions where botanical research is prosecuted. It may further be pointed out that in another case where the lithoprint reproduction can be had for the very modest price of \$3.00, a dealer has recently demanded \$375.00 for a copy of the rare original; and it is a curious fact that the modern reproduction is not only easier to consult, but is actually clearer than is the rare original. As another case of recent exorbitant asking prices may be cited two items, which the Arboretum fortunately already possessed, where copies were offered in 1946 at \$4000.00 each; and yet one of these was offered only two or three years ago for about one-third of the price now asked. Unfortunately, with these inflated prices the items, if sold, pass into the possession of wealthy bibliophiles, and so become lost to working botanists who need access to them.

The cost of reproducing all of these lithoprint reproductions has been covered by private funds supplied by the director, but the institution receives the credit, for each bears the Arnold Arboretum imprint. There are so many rare volumes that are in relatively great demand, and the asking prices are so exorbitant that they are quite beyond the financial limitation of the average botanist, or, for that matter, the average botanical institution, that any institution that might elect to exploit this field could not only reimburse itself for the expenditures involved, but could actually make this field a source of revenue, where additional income is needed.

The Library. — Two hundred and ninety bound volumes were added to the library and 147 pamphlets were catalogued, bringing the totals to 46,131 and 13,753 respectively. Five hundred and seventy author and subject cards were filed in the main catalogue and 4,930 cards were distributed into the Gray Herbarium card index.

Inter-library loans were many and varied, the total number handled, including incoming and outgoing loans, reaching the impressive figure of 686, the number increasing year by year. Our own borrowings are very largely limited to other Harvard libraries, it being only occasionally that we have to go outside of the Boston area for a needed book. This service is one that is very greatly appreciated by staff-members of other institutions where the library facilities are much more limited than is the case here. This is another field where the institution can be of very great service to others in actual loans of needed volumes, or in having microfilm or photostat reproductions made where the high value or extreme variety of a volume renders its loan undesirable. During the year many orders for microfilm and photostat work were filled, in some cases covering entire volumes.

The large photograph collection fills a distinct need, it being much consulted by students, by nurserymen who are planning new catalogues, and by authors seeking illustrations for their about-to-be-published books.

Much time is devoted each year to scanning second-hand book catalogues. Although it is relatively rare that we thus locate a needed work that we do not have, occasionally an item well worth while is located. This year perhaps the most noteworthy case was a nearly complete set of the very rare Rafinesque "Specchio delle scienze" (1814), with, most surprisingly, its original fascicle covers. In this case we realized what we were purchasing even if the dealer did not realize what he was selling, as the price paid was a very modest one.

Much attention has been given to the matter of reinitiating our exchanges of technical publications with foreign institutions in former enemy or enemy-occupied countries. Contacts have been reinitiated so far with forty institutions in eleven countries. It is interesting to note that in each case, each institution had reserved a set of its technical publications to be sent in exchange for ours, immediately this became possible following the close of hostilities.

It is realized that we shall have difficulties in filling the *lacunae* in certain sets of technical periodicals due to the loss of reserve stocks of current issues in certain publishing centers, such as Berlin, Leipzig, Tokyo, and other cities devastated by war. Doubtless in some cases we shall have to be content with microfilm or photostat records. However, every effort will be made to complete the files in the case of essential publications.

Linnaean microfilms. — The acquisition by the Arboretum of a complete microfilm record of the Linnaean Herbarium was mentioned in previous annual reports. A complete set of 5×7 prints has now been made

from this microfilm, and these prints are filed in the Arboretum Library in two steel 5-drawer cabinets. Each print is mounted on a stiff card measuring $7\frac{1}{2}$ by $9\frac{3}{4}$ inches, occupying about half of the card. On the other half is a printed label bearing such pertinent information as the name of the plant in the Linnaean Herbarium, the number under which it is described in Mr. S. Savage's "A Catalogue of the Linnaean Herbarium" (1945), etc. There is ample room on each card for annotations pertaining to the proper modern name of the species, original place of description, references to critical discussions, etc. It is believed that the collection will be more useful maintained as a unit in the sequence of the Linnaean Herbarium than if the prints were scattered in the general herbarium. Each mounted photograph may be removed from the files for examination and comparison with specimens. Such a collection will increase in value as it is used, as annotations by competent authorities are added to the cards. The total number of entities is 14,207, but on about 462 cards there are two or even three photographs, due to the fact that certain specimens were photographed more than once to show details, important annotations, etc. The collection, therefore, contains approximately 14,669 photographs.

These prints, while scarcely sharp enough to make good half-tone reproductions, do generally supply a fairly graphic representation of what Linnaeus had before him. From a critical examination of these photographic records in association with the printed Linnaean record and in association with actual specimens collected in the various historical localities, one can generally gain a very definite idea as to what a Linnaean binomial, that was based on an actual specimen, actually applies. The Arboretum is very fortunate in having this photographic record, for here again it is now in a position to assist botanists elsewhere by loaning individual prints that may be required for examination.

Atkins Institution of the Arnold Arboretum.—With the initiation of an active campaign toward the end of the preceding year to remedy the overgrown conditions of the plantings, very excellent progress has been made and practically all signs of neglect have been removed under the vigorous campaign initiated by Mr. Walsingham. Even the coarse grass was removed from the stream-beds, which were cleaned during the dry season, as well as that in the boundary fences. The year incidentally was more favorable than the preceding one, with a much more ample and better distributed rainfall (56 inches). There were no severe storms, nor were low temperatures recorded during the winter months. Taking advantage of favorable conditions, additional plantings were made in the *Albizzia*, *Bauhinia*, *Cassia*, *Ficus*, and other sections, and over 300 small palms that had been grown in pots were planted in the garden.

Work was initiated in June on the regeneration of a native forested area in Belmonte. Several hundred seedlings of teak, lemon wood, and mahogany were planted, and about 500 seeds of both teak and mahogany were

planted *in situ*. If the resulting young plants withstand the dry season this interplanting will be extended next year. Eight of the new cement beds were used for sowing teak seeds, four in April and four in May. Excellent germination resulted and there may be available between two and three thousand seedlings by next year for transplanting.

Essential repairs were made to the watchman's house, and the new cement water cover on the nursery site, which had cracked at the corners, was repaired and is again in service. In the renovation program from October onward, after the planting was finished, most of the labor force was assigned to a general clean-up of the entire garden area. The results are very striking.

While, as in the preceding war years, no students were actually in residence, many more individuals visited the institution than in recent years, some spending from a week or two to as many as eight or ten weeks. Various Cuban government officials continue their interest in the institution by visiting it at intervals.

In June over 600 packages of seed were received from the New York Botanical Garden from the Mexican collections of Mr. E. J. Alexander. From other sources 82 packages were received, and 97 lots were collected from plants growing in the garden for local use. During the year the distribution comprised 323 packages of seeds, 263 living plants, and 27 lots of cuttings for propagation. It is becoming more and more evident that in the mature plants now being grown at Soledad, both native and exotic species, an exceedingly valuable asset is now actually available in Cuba for the benefit of that country.

Under the reorganization plan which has been approved and is now actually in effect the Atkins Institution has been divorced from the Arnold Arboretum, and henceforth will be known as the Atkins Garden and Research Laboratory, under the direction of Dr. Arthur G. Kevorkian, who will spend a part of each year in Cambridge and a part at Soledad.

Publications. — As usual, four numbers of the Journal were published; these included 16 papers by 12 authors, a number smaller than average because of the length of important contributions by Dr. Allen (in volume 26, numbers 3 and 4) and by Dr. Raup (in volume 27, number 1). No numbers of *Sargentia* were published, but one issue, containing an account of the botany of southwestern Mackenzie by Dr. Raup, is in press, and the manuscripts of one or two additional numbers are well advanced. The usual numbers of *Arnoldia*, our bulletin of popular information, a service that is highly considered in both professional and amateur horticultural circles, were published.

In addition to the periodical publications mentioned above, two major works by staff-members are now in press. The first of these, Prof. Rehder's *Bibliography of Cultivated Trees and Shrubs*, is an extensive work giving the synonymy and full bibliography of all the entities in his much consulted *Manual of Cultivated Trees and Shrubs*. The other is the second part

of Mrs. McKelvey's *Yuccas* of the United States, an extensive treatment which will complement the first part, published in 1938. The second part of this very important study will be published in the same format as the first part and will similarly be elaborately illustrated by the author's striking photographs.

A number of technical and popular papers prepared by staff-members were published elsewhere. A bibliography of the papers published by staff-members and students follows.

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